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(54) Hook fastening material for mechanical fasteners comprising differing prongs

(57) An improved hook fastening material for mechanical fastening systems of the hook and loop type is disclosed. The hook fastening material of the present invention comprises different prongs thereby allowing effective engagement with a large variety of receiving surfaces. Another object of the present invention is a disposable absorbent article comprising the hook fastening material of the present invention.

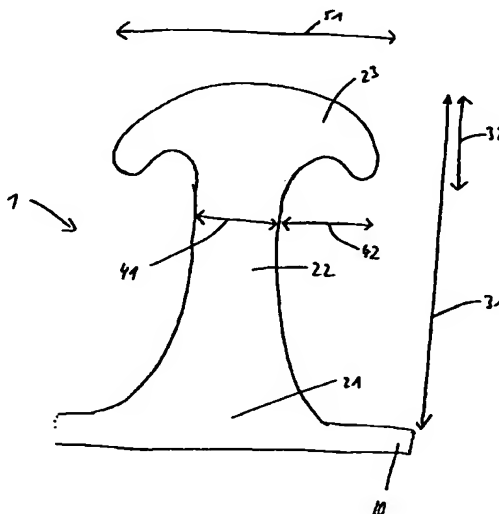


Figure 1

EP 0 988 808 A1

Description**FIELD OF THE INVENTION**

5 [0001] The present invention relates to re-fastenable mechanical fastening systems and more particularly to hook fastening materials deployed in such fastening systems. Still more particularly, the present invention provides hook fastening materials having differently shaped prongs to effectively engage with different types of receiving surfaces.

BACKGROUND

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[0002] Releasably securable mechanical fastening systems are well known in the art. Such fastening systems are commonly used to secure two or more articles together or to secure two or more pieces of an article together. The fastening system has a substrate and at least one prong comprising a base, shank and engaging means. The prong is joined to the substrate at the base. Contiguous with the base of the prong is the shank, which projects outwardly from the base and substrate. Joined to the shank in spaced relation from the substrate is the engaging means. The engaging means projects laterally from the periphery of the shank and has a surface facing towards the substrate.

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[0003] Securing of the two articles or pieces is accomplished by the engaging means intercepting fibers, strands, or induced localized deformations of a complementary receiving surface. When secured together, the physical obstruction, and resulting mechanical interference or friction, between the engaging means of the fastening system and the fibers, strands or localized deformations of the receiving surface prevents release of the two articles until applied separation forces, such as peel and shear, exceed the resistance of the fastening system and receiving surface to such forces.

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[0004] Generally, the resistance of a fastening system and a receiving surface to separation forces depends on the mutual compatibility of the fastening system and the receiving surface. In particular, the shape of the prongs and of respective counterparts of the receiving surface do require to fit each other in order to secure proper engagement.

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[0005] In many cases, it is desirable that the fastening system will adhere to more than one receiving surface. For example, the fastening system of a diaper offers a greater flexibility when the fastening system can be adhered to other parts of the diaper than just to the designated loop panel. A sanitary napkin that is adhered to the undergarment is used with a large variety of undergarment materials.

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[0006] Conventional fastening systems, however, only comprise prongs of a single type. Therefore, their application range is limited to the specific receiving surfaces they are designed for.

[0007] Hence, it is an object of the present invention to provide a hook fastening material that comprises differing prongs such that it is able to effectively engage with different receiving surfaces.

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[0008] It is a further object of the present invention to provide a mechanical fastening system comprising a hook fastening material with differing prongs and a receiving surface such that each type of prong exhibits a different peel strength when engaged with the receiving surface.

SUMMARY OF THE INVENTION

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[0009] The present invention provides a hook fastening material for use as a component of a mechanical fastening system comprising a substrate, a first prong and a second prong. Each of the prongs of the present invention comprises a base joined to the substrate, an engaging means, and a shank comprising a proximal end joined to the base and a distal end joined to the engaging means. The engaging means of the first prong of the present invention is substantially different from the engaging means of the second prong of the present invention.

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DESCRIPTION OF THE DRAWINGS

[0010]

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FIG. 1 shows a vertical cross-section through a hook fastening material according to the present invention.

FIG. 2 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

FIG. 3 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

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FIG. 4 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

FIG. 5 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

FIG. 6 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

FIG. 7 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

5 FIG. 8 shows a vertical cross section of an alternative embodiment of a prong according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

10 [0011] The present invention relates to hook fastening materials used in re-fastenable mechanical fastening systems of the hook and loop type.

[0012] The term "re-fastenable mechanical fastening system of the hook and loop type" as used herein refers to a multiply fastenable fastening system comprising a hook fastening material and a receiving surface.

[0013] The term "hook fastening material" as used herein refers to a material that comprises a substrate and at least one prong joined to the substrate. The term "substrate" as used herein refers to any exposed surface to which one or more prongs are joined. The term "prong" as used herein refers to a means that is joined to a substrate, that extends outwardly from the surface of the substrate. Each prong comprises a base, a shank, and an engaging means. The base contacts and adheres to the substrate, and supports the proximal end of the shank. The shank projects outwardly from the substrate and the base and terminate in a distal end which is joined to an engaging means. The engaging means project laterally beyond the shanks in one or more directions and may resemble a hook shaped tine. The term "lateral" as used herein refers to a direction generally parallel to the surface of the substrate at the principal prong under consideration. The projection of an engaging means beyond the shank in a lateral direction allows the engaging means to be secured to a complementary receiving surface. The engaging means is joined to, and preferably contiguous with, the distal end of the shank.

25 [0014] The fastening system is secured to a complementary receiving surface. As used herein, the term "receiving surface" to which the engaging means of the fastening system are secured refers to any plane or surface having an exposed face with tightly spaced openings complementary to the engaging means and defined by one or more strands or fibers or, alternatively, which exposed face is capable of localized elastic deformation so that the engaging means may become entrapped and not withdrawn without interference or friction. The openings or localized elastic deformations allow for entry of the engaging means into the plane of the receiving surface, while the strands (or non-deformed material) of the receiving surface interposed between the openings (or deformed areas) prevent withdrawal or release of the fastening system until desired by the user or either the peel or shear strength of the fastening system is otherwise exceeded. The plane of the receiving surface may be flat or curved.

30 [0015] A receiving surface having strands or fibers, is said to be "complementary" if the openings between strands or fibers are sized to allow at least one engaging means to penetrate into the plane of the receiving surface, and the strands are sized to be engaged or intercepted by the engaging means. A receiving surface which is locally deformable is said to be "complementary" if at least one engaging means is able to cause a localized disturbance to the plane of the receiving surface, which disturbance resists removal or separation of the fastening system from the receiving surface.

40 [0016] Suitable receiving surfaces include reticulated foams, knitted fabrics, woven and nonwoven materials, and stitchbonded loop materials, such as Velcro brand loop materials sold by Velcro USA of Manchester, N.H. A particularly suitable receiving surface is a polypropylene non-woven fabric having a basis weight of about 17.1 grams per square meter (0.5 ounces per square yard) made by any suitable commercial carding or spunbonding processes. Suitable non-woven fabrics can be obtained from Veratec Nonwoven Group of the International Paper Company of Walpole, Mass. 02081. Other receiving surfaces may also be used, such as stitchbonded fabric Number 970026 sold by the Milliken Company of Spartanburg, S.C..

45 [0017] The hook fastening materials of the present invention comprises at least one first prong and at least one second prong, preferably an array of first prongs and/or an array of second prongs, joined to a substrate. The first prong of the hook fastening materials of the present invention comprises an engaging means that is substantially different from the engaging means of the second prong.

50 [0018] The term "array" as used herein refers to a plurality of elements which are arranged in a regular pattern. The pattern can be one-, two-, or three-dimensional.

[0019] An advantage of the hook fastening materials of the present invention is that the combination of substantially different prongs allows engagement with a larger variety of receiving surfaces. In particular, it is possible to design a hook fastening material that is capable of adhering to at least two different receiving surfaces.

55 [0020] The term "substantially different" as used herein refers to two engaging means which either

- belong to two different shape categories,
- differ in their material composition, or

- have substantially different dimensions.

[0021] A vertical cross section of one embodiment of the prongs of the present invention is shown in FIG. 1. The prong 1 comprises a base 21 which is joined to substrate 10, a shank 22 and an engaging means 23. The geometry of the prong 1 may be described by the following parameters: shank height 31, engaging means height 32, top shank diameter 41, and engaging means overhang 42. Depending on the individual geometry of the prong 1 additional parameters may be necessary, some parameters may be obsolete.

[0022] FIGS. 2 through 8 show vertical cross-sections of alternative embodiments of the prongs of the present invention.

[0023] As used herein, the term "vertical" refers to a direction perpendicular to the exposed surface of the substrate in the vicinity of the prong under question.

[0024] The following table lists preferred and most preferred values of the geometrical parameters of the prongs of the present invention for a specific application, namely a hook fastening material for disposable absorbent articles.

Table 1

<i>Parameter</i>	<i>Dimension</i>	<i>Preferred</i>	<i>Most preferred</i>
Prong height 31	mm	0.60-1.15	0.75
Engaging means height 32	mm	0.20-0.45	0.30
Top shank width 41	mm	0.21-0.45	0.30
Engaging means overhang 42	mm	0.10-0.28	0.15
Engaging means width 51	mm	0.45-1.00	0.60

[0025] It is to be understood, however, that depending on the desired application many other prong geometries including geometries outside the aforementioned parameter ranges are possible.

[0026] Alternative geometries of suitable prongs 1 are shown in FIGS. 2 through 8.

[0027] The horizontal cross-section of the prong may be circular, elliptic, square, rectangular, triangular, or any other desired shape. As used herein, the term "horizontal" refers to a direction parallel to the exposed surface of the substrate in the vicinity of the prong under question. The prong may have an axis of symmetry perpendicular to the exposed surface of the substrate. Alternatively, the engaging means of the prong may extend to one direction only.

[0028] Engaging means suitable for the prongs of the hook fastening materials of the present invention can be chosen from a wide variety of different shapes known in the art. For example, one well known type of engaging means incorporates hemispherically shaped heads with a planar surface oriented towards the substrate and are typically referred to as being "mushroom-shaped" (see FIG. 2). Such engaging means are generally illustrated in U.S. Pat. No. 4,216,257, issued Aug. 5, 1980 to Schams et al., U.S. Pat. No. 4,338,800, issued July 13, 1982 to Matsuda and European Patent Application Publication No. 0,276,970, filed Jan. 26, 1988 by the Procter & Gamble Company in the name of Scripps. The engaging means may also be cone or pyramid shaped with the apex positioned at the distal end of the engaging means (see FIG. 5 and 8). These embodiments of the engaging means are generally referred to as being "arrow-shaped". The engaging means of the present invention may also be of spherical shape (see FIG. 2) or of disk shape (see FIG. 4).

[0029] Another type of suitable prongs is cut from a loop and is hook shaped, somewhat resembling a candy cane, as illustrated in U.S. Pat. Nos. 3,083,737, issued Apr. 2, 1963 to de Mestral, 3,154,837, issued Nov. 3, 1964 to de Mestral and 3,943,981, issued Mar. 16, 1976 to De Brabander. Other suitable hook-shaped fastening means produced by methods other than the cut loop system are disclosed in U.S. Pat. Nos. 3,629,032, issued Dec. 21, 1971 to Erb and 3,594,863, issued July 27, 1971 to Erb. Various other structure are also taught as suitable for use as the engaging means of the fastening system of the present invention. For example, U.S. Pat. Nos. 3,550,837, issued Dec. 29, 1970 to Erb, 3,708,833, issued Jan. 9, 1973 to Ribich et al. and 4,454,183, issued June 12, 1984 to Wollman disclose alternative types of engaging means.

[0030] The substrate of the hook fastening materials of the present invention is preferably a sheet of material to which the prongs are attached in a desired pattern. The substrate is any exposed surface to which one or more prongs are joined. It should be strong enough to preclude tearing and separation between individual prongs of the fastening system, be a surface to which the prongs will readily adhere and be capable of being joined to an article to be secured as desired by a user. In addition, the substrate is manufactured from a material which is capable of being joined to an article to be secured as desired by a user. As used herein, the term "joined" refers to the condition where a first member or component is affixed or connected to a second member either directly or indirectly. "Indirectly" refers to the condition

where the first member or component is affixed or connected to an intermediate member or component which in turn is affixed or connected to the second member or component.

[0031] The substrate should also be capable of being rolled, to support conventional manufacturing processes, flexible so that the substrate may be bent or flexed in a desired configuration, and able to withstand the heat of the liquid prongs being deposited thereon without melting or incurring deleterious effects until such prongs freeze. However, the substrate may be chilled during the production process of the hook fastening materials, allowing the process to accommodate substrates which otherwise would not be able to withstand the heat of the liquid prongs. The substrate should also be available in a variety of widths. Suitable substrates include knitted fabric, woven materials, nonwoven materials, rubber, vinyl, films, particularly polyolefinic films and preferably polyester films. A polyester film substrate having a basis weight of 17.1 grams per square meter (14.26 grams per square yard) and a thickness of about 0.008 to about 0.15 millimeters (0.0003 to 0.006 inches) has been found suitable. Such materials are commercially available from Hoechst Celanese of Greer, S.C., 29651 and sold under the trade name Hostaphan 2400 polyester film. (More rigid substrates, such as cardboard and the like, may also be used.)

[0032] Preferably, the hook fastening materials of the present invention comprises an array of first prongs and an array of second prongs. The arrays of prongs preferably are joined to the substrate in a regular pattern. The array of the first prongs may be joined to a region of the substrate which different from the region to which the array of the second prongs is joined. The two regions may be spaced apart from each other or they may abut each other. It is also possible that the region of the array of first prongs and the array of second prongs interpenetrate each other. The resulting interpenetration zone according comprises first prongs and second prongs in close proximity to each other, preferably in a regularly alternating pattern.

[0033] Preferably, the number of prongs per unit substrate surface area is between 40 and 110 prongs per square centimeter. Most preferably, the number of prongs per unit substrate surface area is 92 prongs per square centimeter. The distance between two adjacent rows of prongs preferably is between 0.5 and 2 millimeters, most preferably the distance between two adjacent rows of prongs is 0.7 millimeters.

[0034] The hook fastening materials of the present invention can comprise any combination of first prongs and second prongs. The prongs may be comprised of 50% first prongs and 50% second prongs. They may also be comprised of 75% first prongs and 25% second prongs (or vice versa), 90% first prongs and 10% second prongs (or vice versa), or any other combination that achieves the desired effect.

[0035] The hook fastening materials of the present invention may also comprise at least one third prong, preferably an array of third prongs. The third prongs are substantially different from the first prongs and the second prongs. The hook fastening materials of the present invention may also comprise even further prongs which are substantially different from the other prongs.

[0036] Another aspect of the present invention is a re-fastenable mechanical fastening system of the hook and loop type comprising a hook fastening material of the present invention, a first receiving surface, and a second receiving surface. The peel strength of the hook fastening material from each of the two receiving surfaces is substantially different for the at least two types of prongs comprised in the hook fastening material. In particular, the peel strength of the first prong with the first receiving surface is higher than the peel strength of the second prong with the first receiving surface and the peel strength of the second prong with the second receiving surface is higher than the peel strength of the first prong with the second receiving surface.

[0037] The peel strength of a hook fastening material and a receiving surface can be measured according to the standard method having ASTM Designation: D1876-72, "Standard Test Methods for Peel Resistance of Adhesives (T-Peel Test)". Before the test hook fastening material and receiving surface must be brought into engagement with each other using a pressure of 10 Newton per square centimeter.

[0038] Another aspect of the present invention is the disposable absorbent article comprising a hook fastening material of the present invention. The hook fastening materials may be used to fasten the disposable absorbent article around the body of the user or to attach the disposable absorbent article to the undergarment of the user.

[0039] One advantage of the hook fastening materials of the present invention may be that at least one type of prongs engages with the substrate (for example in a folded pre-use condition) avoiding pre-mature opening of the fastening system such as during manufacture of the disposable absorbent article. Another advantage of the hook fastening materials of the present invention is that it may engage with a greater variety of receiving surfaces. Thus, not only the designated receiving surface is available for fastening the hook fastening materials. It may also be possible to engage the hook fastening materials with other parts of the disposable absorbent article given that they made from a suitable material. In case, the fastening means is used to affix the disposable absorbent article to the undergarment of the wearer, a greater variety of undergarment materials is available for engagement.

[0040] As used herein, the term "absorbent article" refers to devices which absorb and contain body exudates, and more specifically, refers to devices which are placed against or in proximity to the body of the wearer to absorb and contain the various exudates discharged from the body. The term "disposable" is used herein to describe absorbent articles which generally are not intended to be laundered or otherwise restored or reused as an absorbent article (i.e., they are

intended to be discarded after a single use and, preferably, to be recycled, composted or otherwise disposed of in an environmentally compatible manner). A preferred embodiment of an absorbent article of the present invention is a diaper. As used herein, the term "diaper" refers to an absorbent article generally worn by infants and incontinent persons about the lower torso. The present invention is also applicable to other absorbent articles such as incontinence briefs, incontinence undergarments, absorbent inserts, diaper holders and liners, feminine hygiene garments, and the like.

[0041] The disposable absorbent article of the present invention preferably comprises a liquid pervious topsheet; a liquid impervious backsheet; an absorbent core, which is preferably positioned between at least a portion of the topsheet and the backsheet, and a fastening system comprising the hook fastening materials of the present invention. Many different types and configurations of such disposable absorbent articles are described in the art and are suitable for the present invention.

[0042] A diaper according to the present invention generally may also comprise leg elastics, side panels, elasticized leg cuffs, an elastic waist feature and other features well known in the art.

Claims

1. A hook fastening material for use as a component of a mechanical fastening system, said hook fastening material comprising:
 - a substrate and
 - a first prong and a second prong, each of said prongs comprising a base joined to said substrate, an engaging means, and a shank comprising a proximal end joined to said base and a distal end joined to said engaging means characterized in that the engaging means of said first prong is substantially different from the engaging means of said second prong.
2. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein the shape of said first prong belongs to another category than the shape of said second prong.
3. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein the material composition of said first prong is different from the material composition of said second prong.
4. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein the dimensions of said first prong are substantially different from the dimension of said second prong.
5. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein the shape of said first prong and the shape of said second prong are selected from the group of
 - hook
 - mushroom
 - arrow
 - spherical
 - disk.
6. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein said hook fastening material comprises an array of said first prongs.
7. A hook fastening material for use as a component of a mechanical fastening system according to Claim 1 wherein said hook fastening material comprises an array of said second prongs.
8. A re-fastenable mechanical fastening system comprising a hook fastening material according to any of the preceding claims, a first receiving surface and a second receiving surface wherein the peel strength of said first prong with said first receiving surface is higher than the peel strength of said second prong with said first receiving surface and the peel strength of said second prong with said second receiving surface.

EP 0 988 808 A1

face is higher than the peel strength of said first prong with said second receiving surface.

9. A disposable absorbent article comprising a hook fastening material according to any of Claim 1 through Claim 7 claims.

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10. A disposable absorbent article comprising a re-fastenable mechanical fastening system according to Claim 8.

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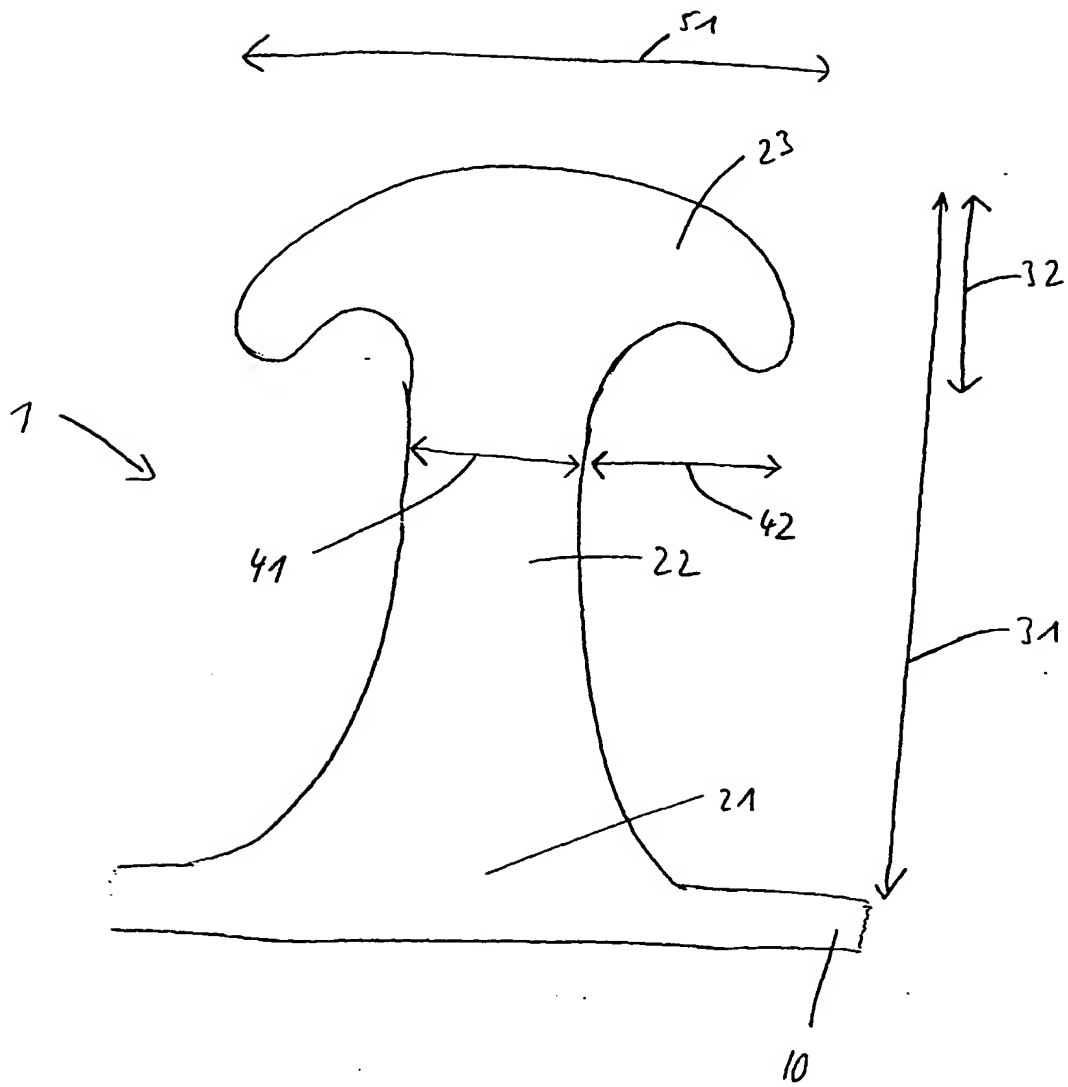


Figure 1

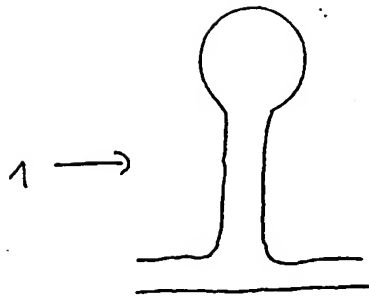


Figure 2

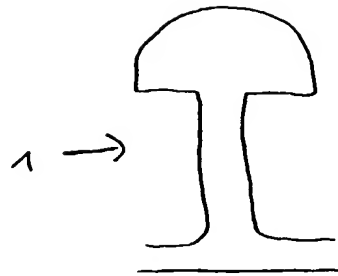


Figure 3

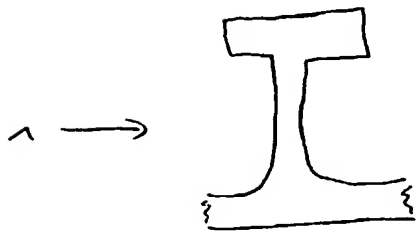


Figure 4

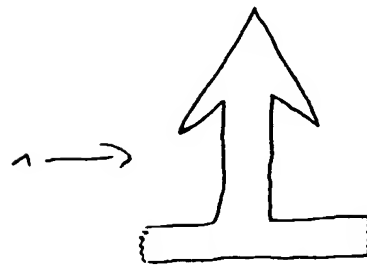


Figure 5

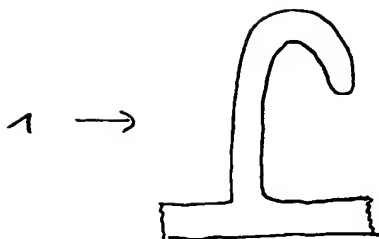


Figure 6

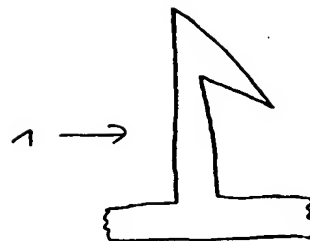


Figure 7

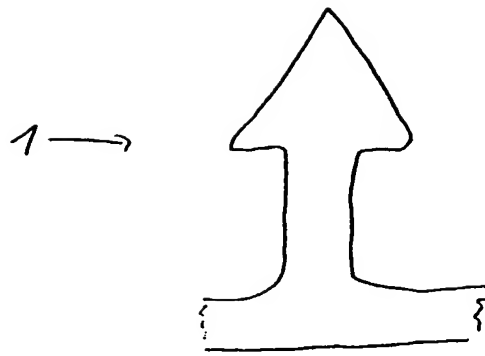


Figure 8



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 98 11 8254

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 198 01 278 A (YKK CORP.) 23 July 1998 * column 9, line 30 - column 10, line 59; claims 1-12; figures 1-7 *	1,2,4-8	A44B18/00
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A44B A61F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 February 1999	Examiner Garnier, F
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 98 11 8254

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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